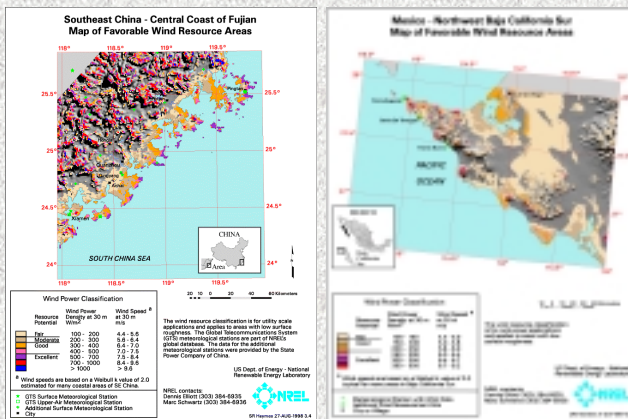


# Wind Resource Assessment

Dennis Elliott, NREL

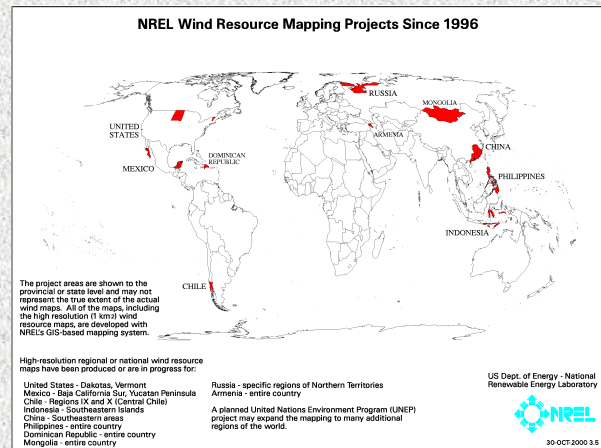
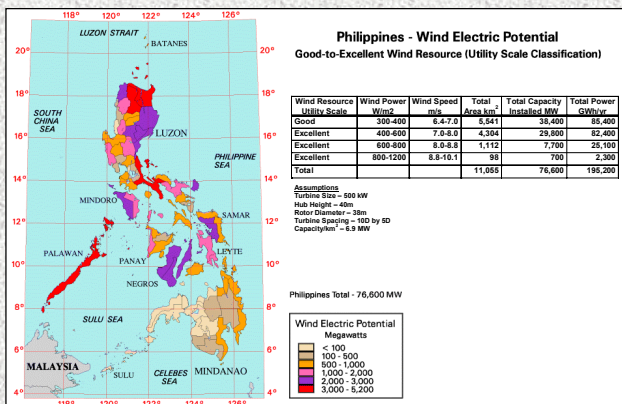
## Wind Mapping at NREL: Overview

- Computerized mapping system started in 1995
- Uses Geographical Information System (GIS) software (ArcInfo® and ArcView®)
- Designed for regional wind mapping (not micro-siting)
- Empirical and analytical approach
- Does not depend on high-quality surface wind observations
- Model inputs: formatted meteorological data and high-resolution (1-km<sup>2</sup>) terrain data



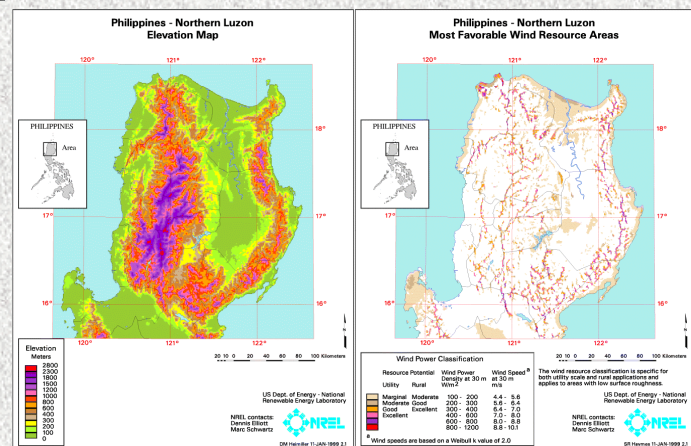
## Wind Mapping at NREL: Outputs

- Final products
  - Wind power density maps (1-km<sup>2</sup> resolution)
  - Topographic maps (1-km<sup>2</sup> resolution)
  - Political and other maps (e.g., wind-electric potential)
  - Summaries of salient wind characteristics (e.g., seasonal/monthly, diurnal, direction frequency)
- Estimates of wind power density displayed for most favorable areas, considering:
  - level of wind resource
  - exposure to prevailing winds
  - terrain slope



## Major Global Data Sets Used by NREL for Wind Resource Assessment

Data Set	Type of Information	Source	Period of Record
Surface Station Data	Surface observations at 20000 stations	NOAA/NCDC	1973-1999
Upper Air Station Data	Weather balloon observations at 1800 stations	NCAR	1973-1999
Satellite-derived Ocean Wind Data	10-m ocean wind speeds gridded to 0.25 deg	NASA/JPL	1988-1999
Marine Climatic Atlas of the World	Gridded (1.0 deg) statistics of historical ship wind data	NOAA/NCDC	1854-1969
Reanalysis Upper Air Data	Model-derived gridded (~200km) upper air data	NCAR	1958-1999
Global Upper Air Climatic Atlas	Model-derived gridded (2.5 deg) upper air statistics	NOAA/NCDC	1980-1991
Digital Geographic Data	Political, hydrography, etc.	ESRI	
Digital Terrain Data	Elevation - 1 km resolution	USGS/EROS	



## Wind Mapping at NREL: Conclusions

- Cursory mapping methods in previous wind resource surveys had insufficient detail and underestimated the wind potential in many areas.
- Comprehensive approach and advanced GIS and other modeling techniques have been used to produce more detailed and reliable assessments of the wind resource.
- High-resolution wind maps show many areas of good-to-excellent wind potential not previously recognized.
- These new wind maps have motivated country officials to explore wind as serious grid and off-grid options for the development of their energy resources.